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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/696,286	10/28/2003	Guatam Parthasarathy	10020/18304	5111
26646	7590	06/03/2004	EXAMINER	
KENYON & KENYON ONE BROADWAY NEW YORK, NY 10004			ROY, SIKHA	
			ART UNIT	PAPER NUMBER
			2879	

DATE MAILED: 06/03/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application N .

10/696,286

Applicant(s)

PARTHASARATHY ET AL.

Examiner

Sikha Roy

Art Unit

2879

-- The MAILING DATE of this communication appears on the cover sheet with the corresponding address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 28 October 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 26-38 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 26, 28, 29 and 33-38 is/are rejected.
- 7) ☒ Claim(s) 27 and 30-32 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>1203</u> . | 6) <input type="checkbox"/> Other: _____  |

### **DETAILED ACTION**

The Preliminary Amendment, filed on October 28, 2003 has been entered and is acknowledged by the Examiner.

#### ***Specification***

The disclosure is objected to because of the following informalities. Referring to page 14 lines 8,9 and page 15 lines 18,19 the specification should be updated to give current status of the cited applications.

Appropriate correction is required.

#### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 26, 28, 29, 33-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,013,384 to Kido et al. and further in view of "Interface engineering in preparation of Organic Surface-emitting Diodes" by Hung et al. in Applied Physics Letters, v. 74, n. 21, pp. 3209-3211 (May, 1999).

Regarding claim 26 Kido discloses (Fig.1 column 3 lines 22-51, column 4 lines 52-65) method of fabricating an organic light emitting device comprising laminating in sequence on a substrate 1 an anode 2, a hole transport layer 3, an organic electron transport layer, an electron injection layer (metal doped organic compound layer) 5 and an electron injecting layer 6 (cathode electrode). Kido further discloses the electron

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injection layer is formed by doping bathophenanthroline, the transparent electron injection layer with metal (Li). Kido discloses phenanthroline, bathophenanthroline forming transparent electron injection layer which are known to be exciton-blocking as evidenced by U.S. Patent 6,451,415 to Forrest et al.(column 7 lines 60,61).

Claim 26 differs from Kido in that Kido does not exemplify the electron injecting layer (cathode electrode) being transparent.

Hung et al. in the same field of endeavor of organic light emitting diodes disclose (page 3209, column 1 lines 1-13, column 2 lines 36-41) transparent ITO sputtered deposited on top of multilayer structure as electron injecting layer. Furthermore Hung discloses that this configuration provides the emission of light from top surface providing high resolution. Furthermore the surface-emitting structure is required for an active-matrix OLED display fabricated on opaque Si substrate, which has an important advantage of having on-chip data and scan drivers allowing ultra-high pixel resolution.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to substitute transparent ITO for electron injecting layer of Kido as taught by Hung et al. for providing a top-surface emitting structure with high resolution.

Regarding claim 28 Kido discloses (column 10 example 2) the electron injection layer of bathophenanthroline and doping metal Li co-deposited on the luminescent layer 4 to form the metal-doped layer 5. Kido fails to disclose that the transparent electron injection layer is doped with metal by depositing an ultra-thin layer of metal on the electron injection layer prior to depositing electron injecting layer.

Hung discloses (page 3210 column 2 30-33, page 3211 column 2 lines 1-7) an ultra-thin film of Li is deposited on the electron injection (CuPc) layer followed by sputter deposition of ITO. Hung discloses that fast diffusion of Li in the electron injection layer will result in sufficient amount of Li at the surface of the electron transport (Alq) layer to lower the injection barrier from the electron injection layer to electron transport layer and furthermore some Li is left at the CuPc surface resulting in enhanced electron injection from ITO to CuPc.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to dope the electron injection layer of Kido by depositing ultra-thin film of Li on the electron injection of bathophenanthroline layer prior to depositing electron injecting layer as suggested by Hung et al. for providing sufficient amount of Li at the surface of the electron transport layer to lower the injection barrier from the electron injection layer to electron transport layer and some Li left at the electron injection layer surface resulting in enhanced electron injection from ITO.

Regarding claim 29 Hung discloses the transparent electron injecting layer comprising ITO.

Regarding claim 33 Kido discloses metal-doped electron injection layer comprising bathophenanthroline (2,9-dimethyl-4,7-diphenyl-1,10-phenanthroline).

Regarding claims 34,35 Kido and Hung disclose the claimed invention except for the limitation of 'metal-atom density in electron injection layer sufficient to produce electronic density of at least about  $10^{15}/\text{cm}^3$  (claim 34),  $10^{21}/\text{cm}^3$  (claim 35)'. The optimization of prior art structure is generally considered to be within the skill of the art.

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It would have been obvious to one having ordinary skill in the art at the time the invention was made to specify the metal atom density in the electron injection layer of Kido and Hung, since optimization of workable ranges is considered within the skill of the art.

Regarding claims 36 Kido and Hung disclose the claimed invention except for the limitation of 'metal-atom density in electron injection layer sufficient to produce quantum efficiency of at least 1% for the light emitting device'. The optimization of prior art structure is generally considered to be within the skill of the art. It would have been obvious to one having ordinary skill in the art at the time the invention was made to specify the metal atom density in the electron injection layer of Kido and Hung, since optimization of workable ranges is considered within the skill of the art.

Regarding claim 37 Kido discloses (column 6 lines 32-56) the hole transporting layer comprising 4,4-bis[N-(1-naphthyl)-N-phenyl-amino]biphenyl.

Regarding claim 38 Kido discloses (column 4 lines 52-55, column 5 lines 10-20) the electron transporting layer comprising tris-(8-quinolinolato)aluminum.

### ***Allowable Subject Matter***

Claims 27, 30-32 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

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Regarding claim 27 the Prior art of record neither teaches nor suggests the method of fabricating organic light emitting device with all the limitations as claimed and particularly doping the transparent electron injection layer with metal by depositing the ultra-thin layer of the metal on the electron transporting layer prior to depositing the transparent electron injection layer.

Claims 30-32 would be allowable because of their dependency status from claim 27.

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. U.S. Patent 6,280,860 to Ueda et al. and U.S. Patent 6,366,017 to Antoniadis et al. disclose electron injection layer formed under electron injecting electrode in organic light emitting diodes with high luminescence brightness.

### ***Contact Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sikha Roy whose telephone number is (571) 272-2463. The examiner can normally be reached on Monday-Friday 8:00 a.m. – 4:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimeshkumar D. Patel can be reached on (571) 272-2457. The fax phone number for the organization is (703) 308-7382.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

S.R.

Sikha Roy  
Patent Examiner  
Art Unit 2879

Wszg 5/24/04  
Mariceli Santiago